

Amendments to the Claims

This listing of claims will replace all prior versions, and listings of claims in the application.

1. (currently amended) A computer system operable to provide backup copying of data without suspending an application program accessing the data, comprising:

a storage device operable to store block data;

a backup storage device operable to store block data; and

an intermediate block data container operable to store block data,

wherein the computer system is operable to copy a data block from the storage device into the intermediate block data container and copy a data block from the intermediate block data container into the backup storage device during an online data backup process;

~~a file system driver operable to transmit a write request to write to the storage device;~~

~~a storage device driver program operable to read from the storage device and write to the storage device in block mode in response to the write request; and~~

wherein the computer system is operable to manage the online data backup process by:

compiling a list of data storage blocks located in the storage device that are subject to the data backup process;

copying a data storage block to the backup storage device pursuant to the list of data storage blocks; and

suspending a write command that is directed to a data storage block that is subject to the data backup process but has not yet been copied, copying the data storage block that is the subject of a write command to the intermediate

storage device, executing the write command and ~~subsequently~~ copying the data storage block from the intermediate storage device to the backup storage device.

2. (original) The computer system of claim 1, wherein the intermediate block data container is located in a memory location that is external to the computer file system.

3. (original) The computer system of claim 2, wherein the intermediate block data container is located in the storage device.

4. (original) The computer system of claim 3, wherein the intermediate block data container is a separate partition of the storage device.

5. (original) The computer system of claim 1, wherein the intermediate block data container is a file within the file system.

6. (original) The computer system of claim 1, wherein the file system is further operable to write dirty pages to the storage device before initiating a data backup process.

7. (original) The computer system of claim 1, wherein the computer system is operable to:

suspend a write command to the storage device during the data backup process if the intermediate block data container has reached a selected data capacity; and

copy a selected amount of data from the intermediate block data container to the backup storage device.

8. (currently amended) The computer system of claim ~~[[1]]~~ 21, wherein the file system driver ~~is operable to translate~~ translates a write request

addressed to a file located in the storage device received from a user process into one or more block write operations.

9. (currently amended) The computer system of claim [[1]] 21, wherein the file system driver ~~operable to transmit~~ transmits a write request received from an operating system process.

10. (currently amended) The computer system of claim [[1]] 21, wherein the file system driver ~~is operable to provide~~ provides a data block number associated with a block in response to a write command directed to the data block during the online data backup process.

11. (currently amended) A method for providing an online data backup process for backing up data stored on a storage device associated with a computer system to a backup storage device, comprising the steps of:

providing an intermediate data container:

informing an operating system driver that the data is in a backup state;

compiling a list of data blocks located in the storage device that are subject to the online data backup process;

receiving a write operation directed to a listed data block subject to the online data backup process;

determining if the listed data block has been copied;

~~proceeding with~~ executing the write operation if the listed data block has been copied; and

suspending the write operation if the listed data block has not been copied, copying the listed data block to the intermediate block data container, and executing the write operation.

12. (original) The method of claim 11, further comprising the step of copying the listed data block from the intermediate block data container to a backup storage device.

13. (original) The method of claim 11, further comprising flagging a data block once the data block has been copied to the backup storage device.

14. (original) The method of claim 11, further comprising the step of informing the operating system driver that all of the data blocks subject to the online data backup process have been copied to the backup storage device.

15. (original) The method of claim 11, further comprising the step of receiving a data block number associated with the listed data block upon receiving a write operation directed to a listed data block.

16. (original) The method of claim 11, further comprising the step of writing a dirty page to the storage device before informing an operating system driver that the data is in a backup state.

17. (original) The method of claim 11, wherein the step of providing the intermediate block data container further comprises the step of providing a storage device external to the computer system.

18. (original) The method of claim 11, wherein the step of providing the intermediate block data container further comprises the step of providing a selected section of the storage device.

19. (original) The method of claim 11, wherein the step of providing the intermediate block data container further comprises the step of providing a selected file located in a file system associated with the computer system.

20. (original) The method of claim 11, wherein the step of suspending the write operation if the listed data block has not been copied, further comprises the steps of:

determining whether the intermediate block data storage has reached a selected capacity; and

copying a selected portion of the intermediate block data storage to the backup storage device if the intermediate block data storage has reached the selected capacity.

21. (new) The computer system of claim 1, further comprising:

a file system driver operable to transmit a write request to write to the storage device; and

a storage device driver program operable to read from the storage device and write to the storage device in block mode in response to the write request.

22. (new) The method of claim 1, further comprising, upon receiving an indication that the intermediate block data container is close to overload, initiating a temporary slowdown of write operations by slowing down processes whose activity results in write operations into a non-backed-up area.

23. (new) The method of claim 1, wherein a list of data blocks located in the storage device that are subject to the online data backup process includes all blocks of an underlying storage device used by file system data and does not include free space blocks.

24. (new) A system for data backup, comprising:

a storage device;

a backup storage device; and

an intermediate storage device,

wherein, when a write command is directed to a data storage block identified for backup that has not yet been backed up, the identified data storage block is copied from the storage device to the intermediate storage device, the write command is executed on the identified data storage block from the storage device, and the data storage block is copied from the intermediate storage device to the backup storage device.

25. (new) The system of claim 24, wherein the intermediate storage device is external to a file system of a computer that includes the storage device.

26. (new) The system of claim 25, wherein the intermediate storage device is located in the storage device.

27. (new) The system of claim 26, wherein the intermediate storage device is a separate partition of the storage device.

28. (new) The system of claim 25, wherein the intermediate storage device is a file within the file system.

29. (new) The system of claim 28, wherein the file system writes dirty pages to the storage device before initiating a data backup process.

30. (new) The system of claim 25, wherein the system:
suspends a write command to the storage device during the data backup process if the intermediate storage device has reached a selected data capacity; and
copies a selected amount of data from the intermediate storage device to the backup storage device.

31. (new) The system of claim 25, further comprising:

a file system driver used for transmitting the write command to the storage device; and

a storage device driver used for reading from the storage device and writing to the storage device in block mode in response to the write command.

32. (new) The system of claim 31, wherein the file system driver translates the write command received from a user process and addressed to a file located in the storage device into one or more block write operations.

33. (new) The system of claim 31, wherein the file system driver transmits the write command received from an operating system process.

34. (new) The system of claim 31, wherein the file system driver provides a data block number associated with a block in response to the write command directed to the data block during an online backup.

35. (new) The system of claim 24, further comprising means for slowing down processes whose activity results in write operations into a non-backed-up area, in response to an indication that the intermediate storage device is close to overload.

36. (new) The system of claim 24, wherein data blocks in the storage device that are subject to the online data backup process includes all blocks of an underlying storage device used by file system data and does not include free space blocks.

37. (new) The system of claim 24, wherein backed up data blocks are restored on the fly to a different storage device.

38. (new) The system of claim 24, wherein an order in which data blocks are scheduled for backup is changed based on information received from an external source.

39. (new) A method for providing an online data backup, comprising:
identifying data blocks in a storage device subject to online data backup;

receiving a write command directed to an identified data block;
determining if the listed data block has been copied;
proceeding with a write operation if the identified data block has been copied; and

suspending the write operation if the identified data block has not been copied, copying the identified data block to an intermediate storage, and executing the write operation on the data block in the intermediate storage.

40. (new) The method of claim 39, further comprising the step of copying the identified data block from the intermediate storage to a backup storage device.

41. (new) The method of claim 39, further comprising flagging a data block once the data block has been copied to the backup storage device.

42. (new) The method of claim 39, further comprising informing an operating system driver that all the identified data blocks have been copied to the backup storage device.

43. (new) The method of claim 39, further comprising receiving a data block number associated with the identified data block upon receiving the write command directed to the identified data block.

44. (new) The method of claim 39, further comprising writing a dirty page to the storage device before informing an operating system driver that the data is in the backup state.

45. (new) The method of claim 39, wherein the step of copying comprises copying the identified data block to intermediate storage, wherein the intermediate storage comprises an external storage device.

46. (new) The method of claim 39, wherein the step of copying comprises copying the identified data block to intermediate storage, wherein the intermediate storage comprises a selected partition of the storage device.

47. (new) The method of claim 39, wherein the step of copying comprises copying the identified data block to intermediate storage, wherein the intermediate storage comprises a selected file located in a file system associated with the computer system.

48. (new) The method of claim 39, wherein suspending the write operation comprises:
determining whether the intermediate storage has reached a selected capacity;
copying a selected portion of the intermediate storage to the backup storage device if the intermediate storage has reached the selected capacity; and
freeing up available space in the intermediate storage.

49. (new) The method of claim 39, further comprising, upon receiving an indication that the intermediate data storage is close to overload, slowing down processes whose activity results in write operations into a non-backed-up area.

50. (new) The method of claim 39, wherein a list of data blocks located in the storage device that are subject to the online data backup process includes all

blocks of an underlying storage device used by file system data and does not include free space blocks.

51. (new) The method of claim 39, further comprising informing an operating system driver that data in a storage device is in a backup state.

52. (new) The method of claim 39, wherein backed up data blocks are restored on the fly to a different storage device.

53. (new) The method of claim 39, wherein an order in which data blocks are scheduled for backup is changed based on information received from an external source.

54. (new) A computer program product for providing an online data backup, the computer program product comprising a computer useable medium having computer program logic recorded thereon for controlling a processor, the computer program logic comprising:

computer program code means for providing an intermediate storage:

computer program code means for informing an operating system driver that data in a storage device is in a backup state;

computer program code means for identifying data blocks in the storage device subject to the online data backup;

computer program code means for receiving a write command directed to an identified data block;

computer program code means for determining if the listed data block has been copied;

computer program code means for proceeding with a write operation if the identified data block has been copied; and

computer program code means for suspending the write operation if the identified data block has not been copied, copying the identified data block to

the intermediate storage, and executing the write operation on the data block in an intermediate storage.